6.0 RESULTS AND DISCUSSION

6.1 Prediction of PSE Values Using the Selected Models

As mentioned earlier, data from 1993, 1994, and 1995 were used in the regression analysis. Statistical tests were performed on the models which yielded very convincing and satisfactory results. To get an idea about how well the models would perform in the field, data from a different set of control sections collected in different years were selected. These sections were not included in the regression analyses. For 1996, 12 FDBIT and 26 PDBIT sections and for 1997, 10 FDBIT and 19 PDBIT sections were chosen randomly to test the models developed in this study. Both classical and Bayesian regression models were used to predict the PSE values on those pavement sections. At the same time, the rated decrease in the PSE values assigned by the KDOT engineers were also collected. Figures 6.1 through 6.4 show the results graphically.

The PSE values are always assigned as integer numbers. Since the coefficients of regression equations are not integers nor the independent variables, the output from the models are evidently nonintegers. So the output values were rationally rounded up or down to the nearest integer. The predicted PSE values for most of the pavement sections, very closely, approximate the rated PSE values. A few cases of discrepancies were encountered in the KDOT ratings. For example, Project No. 18 in Figure 6.3 (Route K-68), the PSE rating has been increased by two although no rehabilitation action had been taken on this pavement for the last four years. On the other hand, both the Bayesian and Classical regression models suggest that the PSE value should decrease by two. Similarly, other discrepancies in the present rating system were rationally and objectively addressed by the selected models as evident in Figures 6.1 through 6.4.

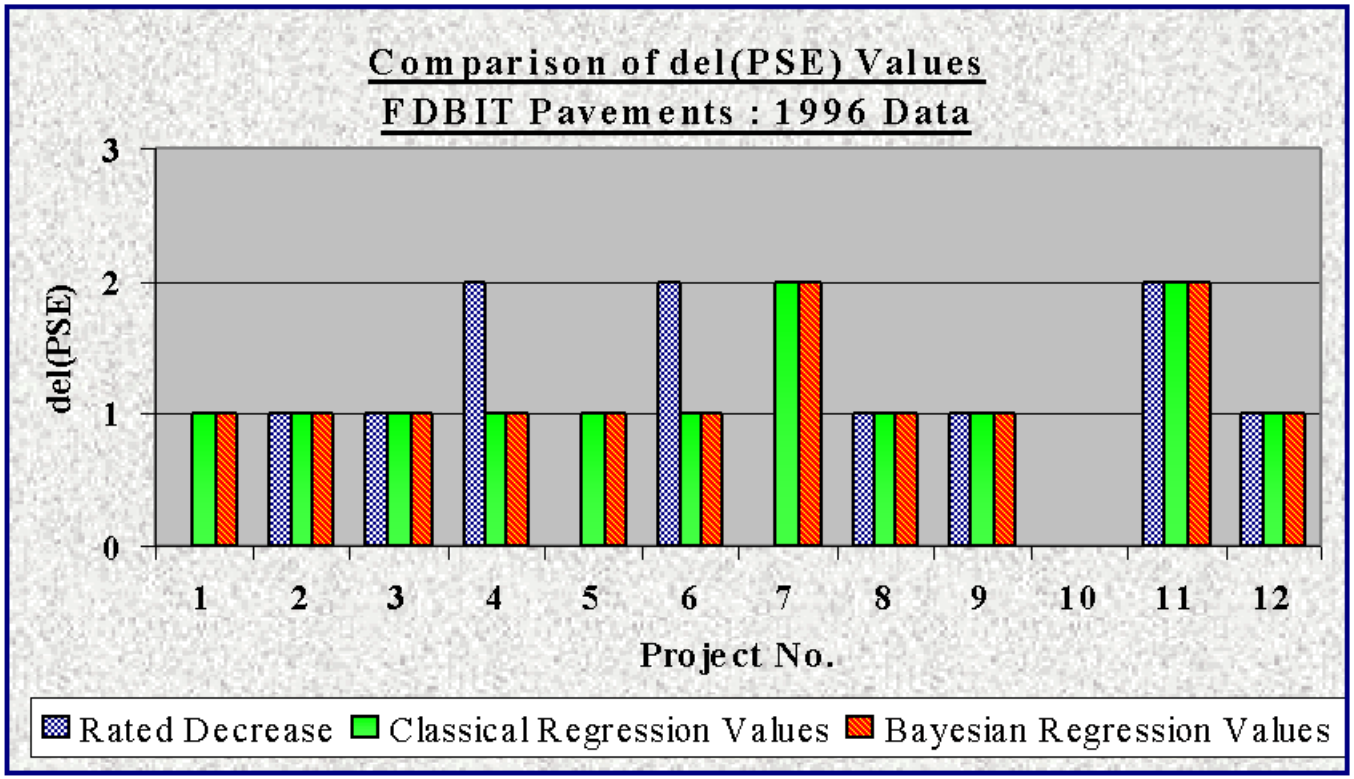

Figure 6.1 Graphical Comparison of Rated and Predicted PSE Values

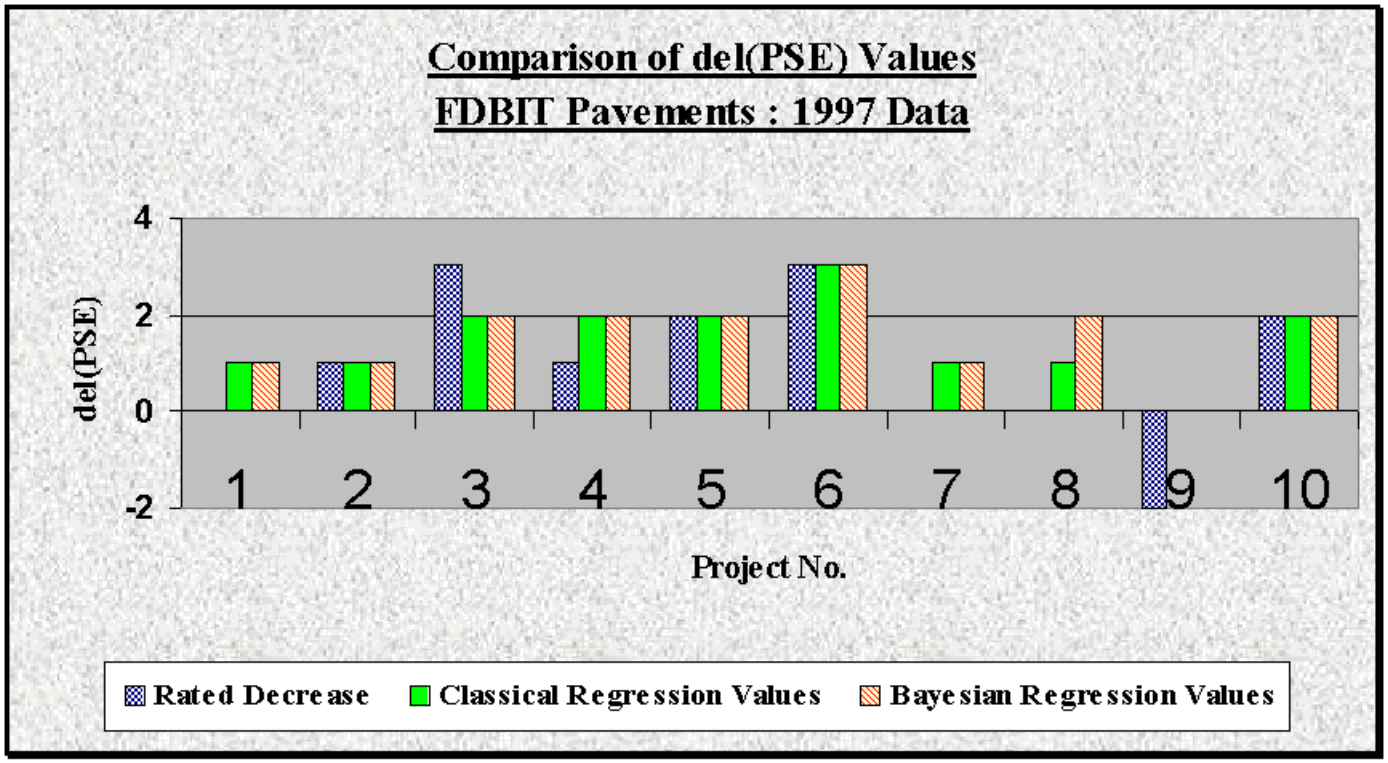

Figure 6.2 Graphical Comparison of Rated and Predicted PSE Values

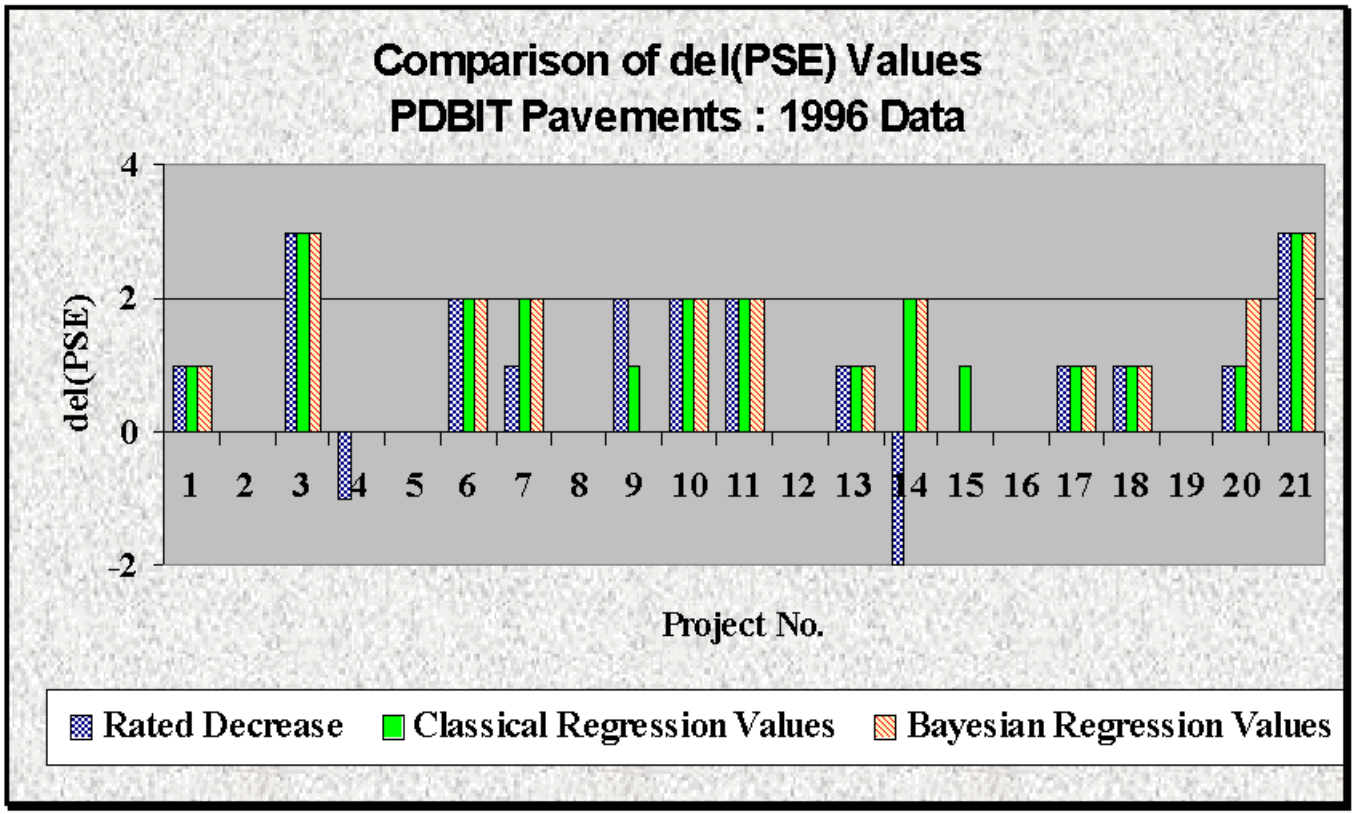

Figure 6.3 Graphical Comparison of Rated and Predicted PSE Values

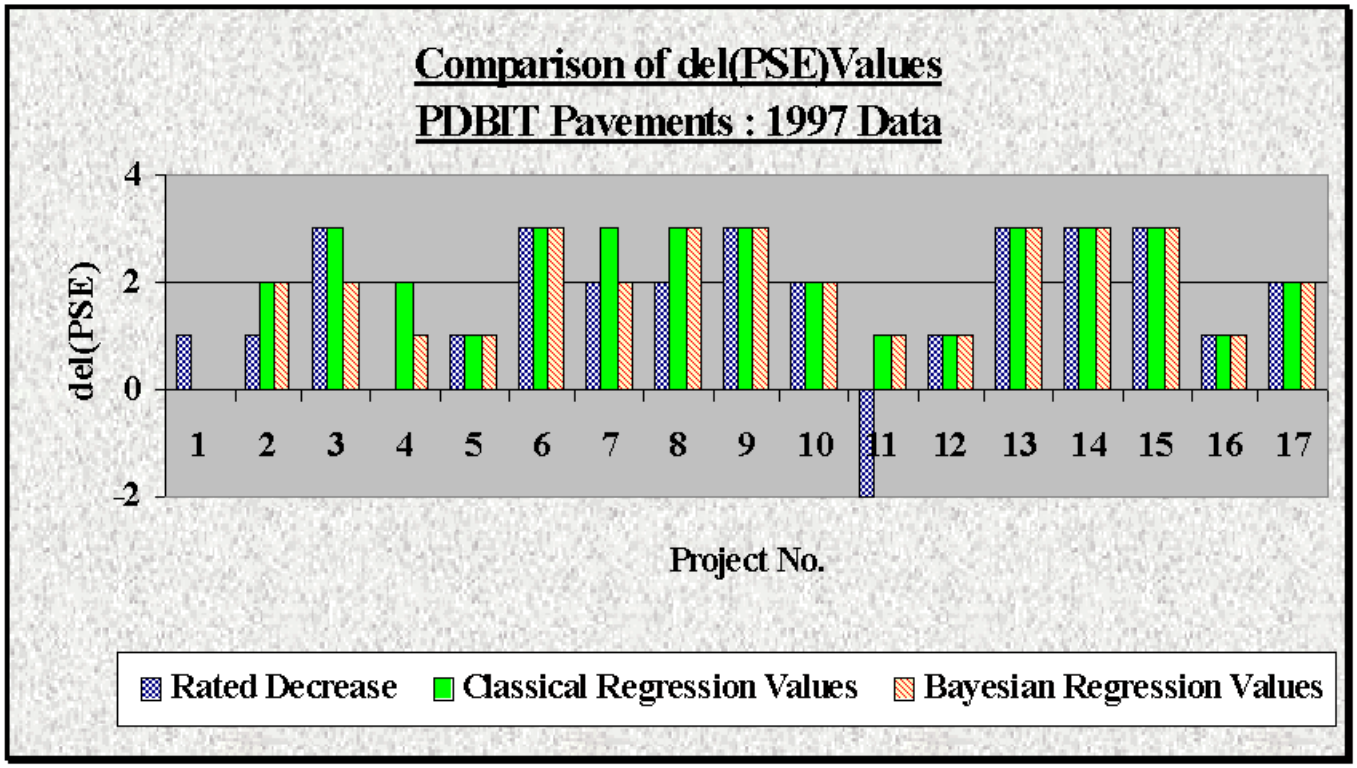

Figure 6.4 Graphical Comparison of Rated and Predicted PSE Values

6.2 Range of the Independent Variables

Like all other regression equations, there is a range of each independent variable for which the selected models are expected to predict the dependent variable with sufficient accuracy. The prediction interval band will be wider outside that range, and it is statistically inaccurate to use the model in those cases. The suggested ranges of the independent variables of the selected models are:

1. Age since last rehabilitation action: (1 to 18 years),
2. AC layer thickness: (4 to 30 inches),
3. PSE rating at the base year: (2 to 10),
4. Decrease in structural number SN: (0.001 to 2.5), and
5. Distress level due to transverse cracking: (1 to 3)

6.3 Paired t-Test Results

Paired t-tests were performed to determine whether the data from two different sources have the same mean or in other words whether they are statistically similar. Rated decrease in the PSE values were compared with the predicted decrease derived from both classical and Bayesian regression. The null hypothesis was:

H_0 : $_1$ = $_2$ (or the two sets of data have the equal means)

which was tested against the alternate hypothesis:

H_a : $_1$ $_2$ (or the two sets of data are significantly different)

The results of the t-tests are tabulated in Table 6.1. The results indicate that for all regression models for both FDBIT and PDBIT pavements the absolute t-value was less than the critical value of t, which implies that the null hypothesis was accepted in all cases. In other words,

Table 6.1 Results of Paired t-Test

PAVEMENT TYPE	RESULTS OF PAIRED t-TEST	
	BAYESIAN	CLASSICAL
FDBIT	t_{crit} (two tail) = 2.079	t_{crit} (two tail) = 2.079
	t = -1.46	t = -1.89
	sum of sq. err. = 16.74	sum of sq. err. = 16.87
PDBIT	t_{crit} (two tail) = 2.015	t_{crit} (two tail) = 2.015
	t = -1.39	t = -1.93
	sum of sq. err. = 7.78	sum of sq. err. = 12.41

there was no significant difference between the two sets of data. From the sum of squared errors, it can be concluded that for the FDBIT pavements the Bayesian and classical regression models yield similar results, while for the PDBIT pavements, the Bayesian regression models appear to be more accurate.